United States
Environmental Protection
Agency

EPA Proposes Cleanup Plan for Tittabawassee River's Segment 2

Tittabawassee River, Saginaw River and Bay Site
Midland, Saginaw and Bay City, Michigan July 2013

The U.S. Environmental Protection Agency, working with the Michigan Department of Environmental Quality, plans to clean up dioxin-contaminated sediment and riverbanks in Segment 2 of the Tittabawassee River. Segment 2 is a 4-mile stretch of the river below the Dow Chemical Co. Plant in Midland.

Within Segment 2 there are distinct areas that require cleanup. They are called Sediment Management Areas, or SMAs, and Bank Management Areas, or BMAs. (*See map, Page 4.*)

Since each area is different, EPA's plan calls for a combination of steps. In some areas, workers will cover or stabilize the contamination to stop it from moving. In other areas, workers will dig up and haul away contaminated sediment. In still other areas, EPA will monitor and maintain work that has already been done. Here is what EPA proposes for each area:

- SMAs 2-1 and 2-2 – Monitor and maintain existing caps.
- SMAs 2-3 and 2-4 – Dig up contaminated sediment and remove it.
- SMA 2-5 – Cover contaminated sediment to keep it safely in place.
- BMA 2-1 and BMA 2-2 – Monitor and maintain existing cleanups that stabilizes the contaminated riverbank and stops erosion.
- BMAs 2-3 through 2-7 – Apply a cleanup method to stabilize the bank and stop erosion based on input from the property owner and features of the riverbank.

Your comments are needed

EPA will not select a cleanup plan until after it reviews comments received from the public at a meeting and during the public comment period.[1] EPA may modify the proposed cleanup plan or select another option based on new information or public comments so your opinion is important. This proposed plan fact sheet gives you background information, describes cleanup options and explains EPA's recommendations. You can find more details in a document called the *Tittabawassee River Segment 2 Response Proposal.* EPA wants your comments on this technical report, which you can find on our website and at local information repositories listed on Page 7.

EPA will be accepting comments from July 8 to Aug. 22[2]
(*See box, left, for ways you can participate in the decision-making process.)*

Share your opinion

EPA invites your comments on this proposed cleanup plan for Segment 2 of the Tittabawassee River.

The public comment period is July 8 – Aug. 22. There are several ways to comment:

- Orally or in writing at the public meeting.
- Fill out and mail the enclosed comment form, or submit it at the meeting.
- Go to www.epa.gov/region5/cleanup/dowchemical and link to the public comment form.
- Fax to Patricia Krause at 312-697-2568

Public Meeting

EPA encourages you to attend the public meeting, Wednesday, July 24, 6:30 p.m., at Freeland High School, 8250 Webster Road, Freeland. EPA will be available at 6 p.m. for informal discussion.

Contact EPA

If you need special accommodations at the public meeting or have questions, contact:

Patricia Krause
Community Involvement Coordinator
312-886-9506
krause.patricia@epa.gov

Don de Blasio
Community Involvement Coordinator
312-886-4360
deblasio.don@epa.gov

You may call EPA's Chicago office toll-free at 800-621-8431, 9:30 a.m. – 5:30 p.m. weekdays

[1] *Section 117(a) of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA, known as the Superfund law) requires EPA to provide an opportunity for public input with a comment period. This fact sheet summarizes a document called the "Tittabawassee River Segment 2 Response Proposal," which is an engineering evaluation/cost analysis developed under EPA's non-time critical removal authorities, and other site-related reports. All official site documents can be found at the repositories listed on P. 7 and at the EPA Region 5 office in Chicago.*

[2] *EPA expects that the public will want more than the normal 30-day public comment period and therefore is providing in advance a 15-day extension to the public comment period pursuant to Section 300.415 (n)(4)(iii) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP).*

Plan builds on previous work

Segment 2 is the next stretch of the river to be cleaned up. Some of what's proposed is similar to previous cleanup work done in other areas of Segment 2. Several of the earlier pilot cleanups are being finalized in this proposed plan.

EPA has studied Segment 2 extensively, taking many samples and evaluating sediment and riverbanks to see how they change or erode over time. EPA has also been involved in studies to show how contaminants build up in the food chain.

Dioxin is the main contaminant in Segment 2. Some areas have high levels of dioxin, while in other areas the contamination is not as high. EPA will begin cleanup in distinct sediment and riverbank areas, and continue to evaluate other places where cleanup may be needed.

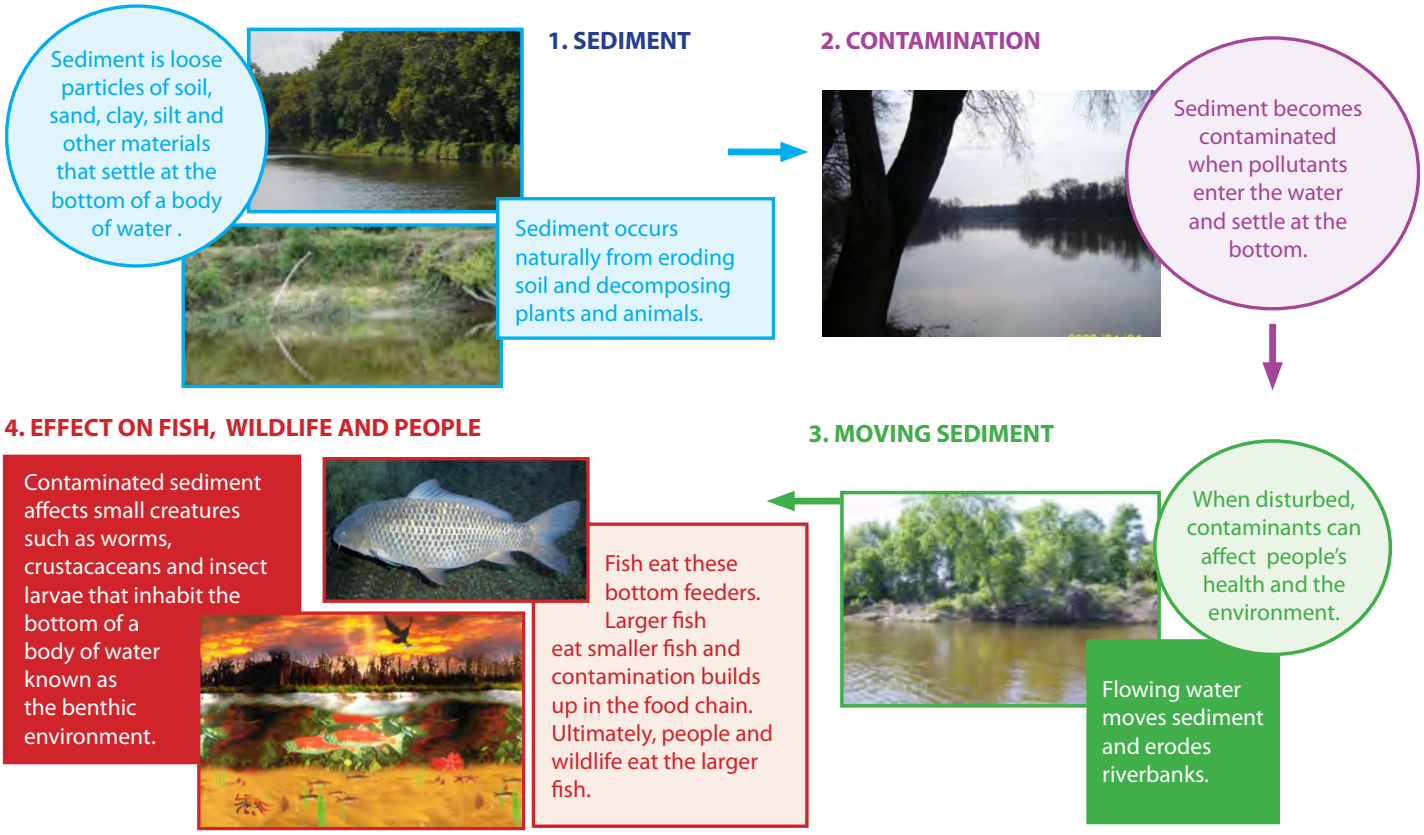
Five distinct SMAs in Segment 2 have been identified to date. These areas include deposits that contain higher levels of dioxin that built up over time. Seven distinct BMAs have been identified by three criteria: the banks formed during the industrial age as floods deposited levees, they are the least stable and they could be a significant way for dioxin to get back in the river if the banks erode.

Why is cleanup action important?

Dioxin in the top layer of sediment can build up, or bioaccumulate, in the food chain. When people or animals eat fish from the river they are being exposed to small amounts of dioxin. The contamination in deeper sediment and in the riverbanks is a concern because erosion of these areas can move contamination into surface sediment or downstream.

EPA has two main cleanup goals for these Segment 2 actions. First, reduce the spread of dioxin-contaminated riverbank soil and sediment to keep dioxin levels low in Segment 2 and farther downstream. Second, help keep dioxin from building up in fish in the Tittabawassee River. When EPA later proposes a cleanup for the floodplain, the riverbanks will be evaluated again.

About Contaminated Sediment and Fish



Background

The Dow Chemical Co. has been operating at its Midland plant since the 1890s. Dioxin (primarily furans) is found in and along the Tittabawassee and Saginaw rivers and in Saginaw Bay from former waste management practices at Dow's Midland plant. In the past, chemicals got into the Tittabawassee River where they settled in some sediment and built up in some riverbanks, like the SMAs and BMAs in Segment 2. It is believed that current waste management practices now control contaminant releases from Dow's facility.

The term "dioxin" refers to a large family of similar chemicals, including furans. EPA has concluded that some dioxin may cause cancer or other health effects such as skin problems, liver damage and reproductive issues, depending on exposures. Dioxin is not created intentionally but can be formed by human activity or naturally — by fires, for example. In this case, dioxin formed as byproducts of Dow's early manufacturing processes. Dioxin binds strongly to particles of soil or sediment and does not dissolve in water.

EPA, working with MDEQ, is directing Dow's investigation and cleanup of the river. The Tittabawassee River has been divided into seven segments ranging from three to five miles each. Work is being done in stages from upstream to downstream, segment-by-segment. Segment 1, a 3-mile stretch next to Dow's Midland plant, is the most upstream segment. Cleanup of Segment 1 started in 2012 and is expected to be complete in 2013.

Summary of cleanup alternatives

SMA cleanup alternatives: There are three alternatives to clean up the SMAs. The alternatives may be applied singly or in combination. Here is a brief description of the sediment technologies:

- SMA Alternative 1: Monitored natural recovery relies on natural processes to reduce contaminant levels and risks over time.
- SMA Alternative 2: Capping places clean material such as sand or gravel over contaminated sediment. An innovative sediment cleanup approach used in earlier cleanups is called a cellular confinement system cap. The CCS cap fills naturally to isolate and contain the sediment and to prevent erosion. (*See box on this page.*)
- SMA Alternative 3: Removal involves taking sediment from the river with heavy equipment. Water is managed, and the sediment is hauled off-site to an approved location for disposal.

Sediment moving into the leading edge of CCS cap in Segment 2.

What is a CCS Cap?

EPA piloted CCS caps in Segment 2 of the Tittabawassee River. This innovative approach placed a grid-shaped geocell material on top of the sediment deposit. Geocell is a three dimensional plastic material that captures sediment. The geocell allows the clean sediment moving through the system to fill the grids and remain in place. The CCS cap has a "green" footprint because it uses low-tech methods during construction.

BMA cleanup alternatives: There are two alternatives to clean up the BMAs. These alternatives also may be applied singly or in combination. Here is a brief description of the riverbank soil technologies:

- BMA Alternative 1[3]: Stabilization relies on natural or engineered approaches to prevent riverbank erosion. Stabilization technologies can be as simple as using natural processes to maintain the existing bank soils and slopes by encouraging native, deep-rooted plants to enhance the bank's natural stability. Or, the technologies can include more constructed approaches like bank reshaping or installing bank stabilization products that control erosion, followed by replanting with native plants.
- BMA Alternative 2: Removal involves using heavy equipment to remove targeted bank deposits and haul them off-site for disposal at an approved location. All existing vegetation is removed. After soil is removed, the area is re-graded and replanted.

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[3] In the Tittabawassee River Segment 2 Response Proposal three BMA alternatives are presented. Enhanced Natural Stabilization and In-Place Stabilization have been combined into BMA Alternative 1 in this fact sheet because the design process will examine key riverbank characteristics and will allow for the selection of those stabilization technologies that are best suited to be successfully implemented at each BMA.

Common elements to all alternatives
Some features are common to each alternative. More evaluations will be needed to better understand conditions and identify the final footprint of the work area at each SMA and BMA. Access to the work areas may require temporary roads in the floodplain or work ramps into the river. Any material produced during the cleanup would be disposed of at approved locations. The cleanups would be monitored during and after construction. A health and safety plan will ensure worker and community safety while the work is underway. An operation, monitoring and maintenance plan will be required to ensure long-term effectiveness. Except for the removal alternatives, institutional controls will be required. Institutional controls include administrative and legal controls that help protect cleanup integrity.

Evaluation of alternatives

EPA is required to evaluate these options against the criteria of effectiveness, implementability and cost *(see box on this page)*. These three criteria are used to help compare how the alternatives will meet cleanup goals.

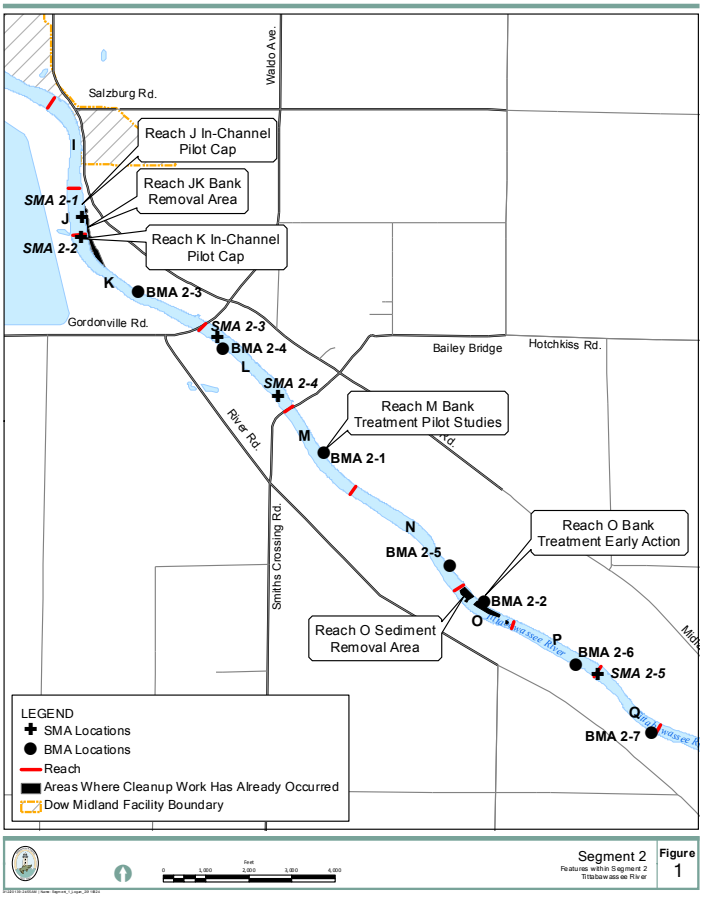
SMA alternatives

Table 1 on Page 5 compares each SMA alternative against the criteria of effectiveness, implementability and cost.

Effectiveness

All SMA alternatives are expected to help protect human health and the environment, meet the cleanup goals and comply with laws and regulations. The location of contaminants within the sediment – either closer to the surface or deeper – can influence the effectiveness of cleanup options. The potential effectiveness of the alternatives differs because of:

Segment 2 of the Tittabawassee River, Saginaw River and Bay Site.



Long-term effectiveness and permanence

All of the alternatives for each SMA are expected to be effective in the long term.

- The time frame to attain protection is uncertain for monitored natural recovery (SMA Alternative 1), especially for SMAs 2-4 and 2-5 where elevated dioxin levels are closer to the sediment surface. This alternative must be closely monitored to make sure it is working on an acceptable timeframe.

- Capping (SMA Alternative 2) provides an immediate benefit by isolating and safely containing the contamination. Capping options at some SMAs offer the benefit of maintaining or enhancing habitat. Caps have to be monitored and may need maintenance to make sure they are reliable in the long term.

- Removal (SMA Alternative 3) would be effective in the long term because it permanently removes contaminated sediment from the river system, preventing exposure or downstream movement. When the contamination extends to the bottom of the sediment or when there is debris, it is very difficult to completely remove all the contaminated material. This is especially difficult when the work is performed in wet conditions. The materials left behind that cannot be removed are called residuals. After removal is complete it is expected that the residuals would be covered quickly by cleaner sediment moving through the system. Debris is expected at all of the SMAs.

Explanation of evaluation criteria

For this type of action, EPA uses three criteria to evaluate and compare cleanup options.

- **Effectiveness** evaluates the ability of an alternative to meet project objectives, and whether it is protective and reliable.
- **Implementability** evaluates how difficult the option will be to complete, whether materials and services are available in the area and whether it is acceptable to the community.
- **Cost** includes the estimated costs to construct the option (for example, equipment, materials and labor), as well as the long-term costs of monitoring and maintaining the option.

Short-term effectiveness

All options except monitored natural recovery would have some short-term effects that would temporarily disrupt areas in and along the river during construction. It is important to understand and work around river flow conditions while the work is under way to lessen short-term effects. Short-term effects would be managed by construction practices.

- Capping takes less time to complete than removal does. Capping could result in short-term turbidity, or a cloudy appearance, in the water.
- Removal could also result in short-term turbidity, release of contaminants to surface water and movement of contaminants downstream during construction, especially when the work is performed in wet conditions. If removal is performed in dry conditions, care is needed to prevent erosion in nearby areas.
- If capping is done using sand or gravel, there would be truck traffic to deliver the clean cover materials. Removal would require truck traffic to take the contaminated sediment to an approved landfill. Construction also may require clearing areas that obstruct access to the site. Removal affects a larger nearby work area than capping using sand or gravel, and significantly more area than a CCS cap.

Implementability

All of the SMA alternatives can be carried out. Similar actions have been done successfully at other areas in the Tittabawassee River. All equipment, personnel and material necessary to implement the alternatives should be locally available. Community acceptance will be evaluated after public comments are received. MDEQ generally supports EPA's recommended options, but will make a final recommendation after considering public comments.

- The implementability of the alternatives differs somewhat because of technical challenges. Both capping and removal are easier during lower-flow conditions. Typically this work is planned later in the summer, but unexpected high flows can bring challenges.
- Capping similar to Alternative 2 has been done with no major challenges. Sediment removal similar to Alternative 3 has been done in the Tittabawassee River in both wet and dry conditions. Buried logs and other debris make removal more difficult and increase the likelihood that residuals may remain.
- Implementability also differs between alternatives because of the need for access to the river. No landowner access is required to implement monitored natural recovery. Capping may require access roads and staging areas on privately held land, particularly for sand and gravel caps. CCS caps provide more flexibility in river access because heavy equipment is not used and the SMAs could be approached by water. Removal would require the greatest degree of site access, including temporary roads and staging areas for heavy equipment, contaminated sediment staging and transport, and water management equipment.

Cost

Table 1 shows the estimated cost for each alternative by SMA. Monitored natural recovery is the least costly and removal is the most costly. The range of costs for capping reflects different cap designs. The range of costs for removal reflects different expected costs for work in dry versus wet conditions. The total estimated cost for EPA's recommended SMA alternatives ranges from $4 million to $4.6 million.

Table 1 – Compares how each SMA alternative meets the evaluation criteria, relative to other SMA alternatives.

	Effectiveness	Implementability	Estimated Cost
Sediment Management Area 2-3			
MNR	Low to Moderate	High	$30,000
Capping	Moderate to High	Moderate to High	$150,000 - $380,000
Removal	Moderate to High	Moderate to High	$1,210,000 - $1,280,000
Sediment Management Area 2-4			
MNR	Low to Moderate	High	$30,000
Capping	Moderate to High	Moderate to High	$360,000 - $670,000
Removal	Moderate to High	Moderate to High	$2,640,000 - $3,060,000
Sediment Management Area 2-5			
MNR	Low to Moderate	High	$30,000
Capping	High	High	$120,000 - $250,000
Removal	Moderate to High	Moderate to High	$770,000 - $990,000

BMA alternatives

Effectiveness

Both BMA alternatives are expected to help protect human health and the environment, meet the cleanup goals and comply with laws and regulations. Current conditions at each BMA can influence the effectiveness of the cleanup options. The BMA alternatives can be effective when applied to a riverbank after taking into consideration characteristics such as bank height and angle, existing vegetation quality and quantity, the potential for river flows to undercut the banks and other considerations. The potential effectiveness of the alternatives differs because of:

Long-term effectiveness and permanence

Both alternatives for each BMA are expected to be effective in the long term.

- Stabilization (BMA Alternative 1) is effective in the long term and ensures that contaminated banks do not erode into the river. A long-term plan to monitor and maintain the banks would be needed.
- Removal (BMA Alternative 2) would be effective in the long term because it removes contaminated riverbank soil from the river system.

Short-term effectiveness

Both BMA alternatives would have short-term effects that would temporarily disrupt areas along the river during construction.

- Stabilization takes less time to do than removal does.
- Removal is expected to have the greatest short-term effects on workers and the community. It requires heavy construction equipment along the riverbank during excavation and re-grading and also truck traffic as contaminated bank soil is transported from the area. Stabilization may also require some construction traffic but it is expected to be significantly less.
- Stabilization would cause the least change to existing riverbank conditions. With stabilization the riverbank habitat would remain or be improved. The materials or approach needed to prevent erosion may change the look of some bank faces and surfaces. Some trees may be pruned to improve light. Also, small vegetation may be removed and replaced with native plants.
- More extensive changes to existing habitats are associated with removal. Removal requires clearing areas of all vegetation before work begins, including mature trees. Efforts to restore disrupted areas are typically part of the removal alternative. However, some habitats require decades to return to their pre-construction condition. The shape of the riverbank would permanently change because of the soil removal.

Implementability

Actions similar to the BMA alternatives have been done successfully along the Tittabawassee River in Segment 2, and both can be implemented. Each alternative is expected to be administratively feasible. Necessary personnel and equipment are available for both options. Community acceptance will be evaluated after public comments are received. MDEQ generally supports EPA's recommended options, but will make a final recommendation after considering public comments.

- Landowner access is required to implement any of the BMA alternatives and may require access roads and staging areas through privately held land.
- The access requirements and need for staging areas are far less for stabilization, easing the ability to implement this alternative. Extremely high or steep banks may pose unique challenges for the placement of certain slope stabilization materials under BMA Alternative 1, and reshaping the banks may be necessary.
- Removal would require the greatest degree of site access, including roads and staging areas for heavy equipment, contaminated soil staging and transport, and equipment decontamination. In areas of dense vegetation or areas where access is limited, the BMA and surrounding areas would require extensive clearing and preparation to allow equipment access to the bank, making implementation of removal more difficult.

Cost

Table 2 shows the preliminary estimated cost of each BMA alternative. Stabilization is the least costly and removal is the most costly. The range of costs for stabilization reflects different amounts of natural stabilization versus engineered stabilization technologies. The total estimated cost for EPA's recommended BMA alternatives ranges from $520,000 to $820,000.

Table 2 – Estimated cleanup costs for Bank Management Areas.

	Stabilization	Removal
BMA 2-3	$89,000 - $142,000	$306,000
BMA 2-4	$64,000 - $106,000	$236,000
BMA 2-5	$78,000 - $126,000	$276,000
BMA 2-6	$211,000 - $320,000	$650,000
BMA 2-7	$78,000 - $126,000	$276,000

EPA's recommendation

EPA, in consultation with MDEQ, recommends the following because these options provide the best balance of effectiveness, implementability and cost:

Segment 2 SMAs. For SMAs 2-1 and 2-2, EPA proposes monitoring and maintaining existing caps because they have been effective since being built, under a range of river flows. For SMAs 2-3 and 2-4 EPA is proposing Alternative 3, removal, because SMA 2-3 is one of the more concentrated deposits remaining in the Tittabawassee and SMA 2-4 is a large deposit with elevated dioxin levels closer to the sediment surface in a stretch where the sediment can move a lot with varying river flows. For SMA 2-5 EPA is proposing Alternative 2, capping, because this small area seems to be stable with good habitat building up nearby, so a cap can enhance the stability and habitat while short-term effects are minimized.

Segment 2 BMAs. For BMAs 2-1 and 2-2, EPA proposes monitoring and maintaining existing bank stabilization actions because they also have been effective since being built. For BMAs 2-3 through 2-7 EPA proposes Alternative 1, stabilization, because these bank stretches have characteristics that indicate that stabilization will be effective and the existing natural habitat will be less affected. There are several technologies included in the stabilization alternative. The design process would examine key characteristics and would allow for the selection of those technologies that are best suited to be successfully implemented at each BMA. The final solution will be developed on a bank-by-bank basis, depending on conditions at that specific location. EPA would work with each property owner to design and install an acceptable stabilization approach.

EPA's estimated costs for all of the cleanups proposed in this fact sheet for Segment 2 range from $4.5 million to $5.4 million. This is in addition to the estimated $8.1 million already spent on prior cleanups in Segment 2. Cost estimates would need to be refined as the cleanups are designed.

Next steps

Before making a final decision, EPA will review comments received during the public comment period. Based on the comments, EPA, working with MDEQ, may modify its recommended alternatives or choose another, so your opinion is important. EPA encourages you to review and comment on this proposed cleanup plan and the *Tittabawassee River Segment 2 Response Proposal*. More details are available in the official documents on file at the information repositories and on EPA's website (*see box at right*).

EPA will respond to comments in a document called a "Responsiveness Summary." This will be part of another document called an "Action Memorandum" that describes the final cleanup plan. The Agency will announce the final plan in local newspapers and will place a copy in the information repositories and the website.

Once the plan is final, EPA expects Dow to implement the work in Segment 2. Dow's work will be done with oversight by EPA and MDEQ. Work is expected to start in 2014 after detailed engineering designs are complete. Work is expected to be completed in 2015. If other SMAs or BMAs are found in Segment 2, similar cleanup methods will be initiated.

For more information

You can see documents related to the Tittabawassee River, Saginaw River & Bay site at www.epa.gov/region5/sites/dowchemical, or at:

EPA Community Information Office,
804 S. Hamilton St., Suite 3, Saginaw

Grace A. Dow Memorial Library,
1710 W. Saint Andrews St., Midland

Hoyt Main Library, 505 Janes Ave., Saginaw

Alice and Jack Wirt Public Library,
500 Center Ave., Bay City

United States
Environmental Protection
Agency

Region 5
Superfund Division (SI-7J)
77 W. Jackson Blvd.
Chicago, IL 60604-3590

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(details inside)